The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1.   A method for transmitting a data stream between a host controller and a peripheral device over an extended distance; said method comprising:

5   a.   feeding a first original, outgoing digital signal from a host controller to a local expander unit;

b.   optionally converting said outgoing digital signals into a converted outgoing signal having a format suitable for transmission over extended distances;

c.   transmitting either said outgoing digital signal or said converted outgoing signal, as a

10   outgoing transmission signal, over a signal distribution system;

d.   receiving said outgoing transmission signal at a remote expander unit;

e.   optionally converting said outgoing transmission signal to said first original outgoing digital signal;

f.   delivering said first original outgoing digital signal from said remote expander to at least

15   one peripheral device;

g.   receiving, at said remote expander, a reply digital signal from said peripheral device;

h.   optionally converting said reply digital signal into a converted reply signal having a format suitable for transmission over extended distances;

i.   transmitting said reply digital signal or said converted reply signal as a reply

20   transmission signal over said signal distribution system;

j.   receiving said reply transmission signal at said local expander;

k.   optionally converting said reply transmission signal to said original reply digital signal;

l.   storing said reply digital signal as a stored reply digital signal until the receipt of a subsequent original, outgoing digital signal from said host controller, which subsequent

25   signal is the same as, or similar to, said first original outgoing digital signal; and

m.   forwarding said stored reply digital signal to said host controller in response to said subsequent original outgoing digital signal.

2.   A method as claimed in Claim 1 wherein said data stream is a time relevant data stream.

30   3.   A method as in claim 2 wherein said digital signals conform to the USB Specification and represent isochronous data.

4.   A method as claimed in Claim 3 wherein said method provides a method for transmission of isochronous data according to the USB Specification wherein isochronous data is transmitted from a peripheral device and is received by a host controller, said method comprising:

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    a. transmitting a request for isochronous data from a host controller to a local expander;

    b. forwarding said request for isochronous data from said local expander to a remote expander over a signal distribution system;

    c. delivering said forwarded request for isochronous data to at least one peripheral device;

    d. transmitting the requested isochronous data from said peripheral device to said remote

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       expander;

    e. forwarding said requested isochronous data from said remote expander to said local expander over said signal distribution system;

    f. storing said requested isochronous data in a packet buffer at said local expander;

    g. transmitting a subsequent request for isochronous data from said host controller to said

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       local expander;

    h. receiving said subsequent request for isochronous data at said local expander; and

       I.   retrieving the stored isochronous data from said local expander;

       II.   delivering said stored isochronous data to said host controller;

       III. forwarding said subsequent request for isochronous data from said local

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          expander to said remote expander over said signal distribution system; and

       IV. repeating steps (c) through (h) for said subsequent request and any further subsequent requests for isochronous data.

5.   A method as claimed in Claim 3 wherein said method provides a method for transmission of isochronous data according to the USB Specification wherein isochronous data

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is transmitted from a host controller and is received by a peripheral device, said method comprising:

    a)   receiving, at a local expander, an original notification of isochronous a host controller;

    b)   forwarding said original notification of isochronous data from said local

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expander to a remote expander over a signal distribution system;

    c)   receiving, at a remote expander, said forwarded original notification of isochronous data;

    d)   delivering said forwarded notification of asynchronous data to at least one peripheral device;

e)   receiving, at a local expander, an original isochronous data packet from a host controller;

f)   forwarding said original isochronous data packet from said local expander to a remote expander over a signal distribution system;

5   g)   receiving, at a remote expander, said forwarded original isochronous data packet; and

h)   delivering said forwarded original isochronous data packet to at least one peripheral device.

6.   A method as claimed in Claim 4 additionally comprising the following steps after
10   step (b) of Claim 4 namely:

i.   Determining whether said local expander already possesses said requested isochronous data;

ii.   Generating a synthetic data packet if no such requested isochronous data is present; and

15   iii.   Delivering said synthetic isochronous data to said host controller.

7.   A method as claimed in Claim 4 additionally comprising the following step after step (c) of Claim 4, namely:

i) Storing the address of the ~~requested~~ peripheral device at said remote expander unit; and further comprising the following steps after step (d) of Claim 4, namely:

20   i) Retrieving the address of said ~~requested~~ peripheral device at said remote expander unit; and

ii) Adding said retrieved address to said requested isochronous data.

8.   A method as claimed in Claim 4 wherein vestigial packets are removed from the system, said method comprising:

25   i) Detecting when a new frame has begun;

ii) Examining the properties of each packet buffer;

iii) Determining whether the data packet contained in said examined packet buffer has been stored for at least one complete frame period;

iv) Discarding said ~~contained~~ data packet if said ~~contained~~ data packet has been stored
30   for at least one complete frame period; and

v) Repeating steps (i) through (iv) for each packet buffer in the system.

9.   A method as claimed in Claim 1 wherein said data stream is a non-time-relevant data stream.

10.   A method as in Claim 9 wherein said digital signals conform to the USB Specification and represent asynchronous data.

11.   A method as claimed in Claim 10 wherein said method provides a method for transmission of asynchronous data according to the USB Specification wherein asynchronous data is transmitted from a peripheral device and is received by a host controller, said method comprising:

a)   receiving, at a local expander, an original request for asynchronous data from a host controller;

b)   forwarding said original request for asynchronous data from said local expander to a remote expander over a signal distribution system;

c)   receiving, at a remote expander, said forwarded original request for asynchronous data;

d)   delivering said forwarded original request for asynchronous data to at least one peripheral device;

e)   receiving, at said remote expander, the requested asynchronous data from said peripheral device;

f)   forwarding said requested asynchronous data from said remote expander to said local expander over said signal distribution system;

g)   storing, in a packet buffer at said local expander, said requested asynchronous data;

h)   receiving, at said local expander, a subsequent request for asynchronous data from said host controller; and

i)   forwarding said subsequent request for asynchronous data from said local expander to a remote expander over a signal distribution system;

ii)   delivering said forwarded subsequent request for asynchronous data to at least one peripheral device;

iii)   receiving, at said remote expander, the requested asynchronous data from said peripheral device;

i)   additionally receiving, at said local expander, said subsequent request for asynchronous data from said host controller as in step (h); and

i)   retrieving the stored asynchronous data from said packet buffer;

ii)   delivering said retrieved asynchronous data to said host controller;

j)   receiving, at said local expander, an outgoing acknowledgement signal from said host controller;

k)   optionally converting said outgoing acknowledgement signal into a converted acknowledgement signal having a format suitable for transmission over extended distances;

l)   transmitting either said outgoing acknowledgement signal or said converted acknowledgement signal, as an acknowledgement transmission signal, over a signal distribution system;

m)   receiving, at a remote expander unit, said acknowledgement transmission signal;

n)   optionally converting said acknowledgement transmission signal to said outgoing acknowledgement signal; and

o)   delivering said outgoing acknowledgement signal from said remote expander to at least one peripheral device.

12.   A method as claimed in Claim 11 additionally comprising the following step after step (b) of Claim 11, namely:

i)   Determining whether said local expander already possesses said requested asynchronous data;

ii)   Generating a negative acknowledgement packet if no such requested asynchronous data is present; and

iii)   Delivering said negative acknowledgement packet to said host controller.

13.   A method as claimed in Claim 11 additionally comprising the following step after step (e) of Claim 11, namely:

i)   generating an acknowledgement packet at said remote expander; and

ii)   delivering said acknowledgement packet to said peripheral device.

14.   A method as claimed in Claim 11 wherein, additionally, a guard time is imposed after a data packet is transmitted from a remote expander to a USB device, which guard time is set to a value that is dependent upon the transfer type of said transmitted data packet, said method comprising:

a)   Receiving, at a remote expander, an outbound data packet,

b)   Determining, at a remote expander, the transfer type of said outbound data packet,

c)   Forwarding said outbound data packet from said remote expander to a USB device,

d)   Setting the value of a transmission guard timer to a value that is dependent upon said determined transfer type; and

e)   Inhibiting further outbound transmissions until said guard timer has expired.

15. A method as claimed in Claim 10 wherein said method provides a method for transmission of asynchronous data according to the USB Specification wherein asynchronous data is transmitted from a host controller and is received by a peripheral device, said method comprising:

5   a)   receiving, at a local expander, an original notification of asynchronous data from a host controller;

      b)   forwarding said original notification of asynchronous data from said local expander to a remote expander over a signal distribution system;

      c)   receiving, at a remote expander, said forwarded original notification of
10 asynchronous data;

      d)   delivering said forwarded notification of asynchronous data to at least one peripheral device;

      e)   receiving, at a local expander, an original asynchronous data packet from a host controller;

15   f)   forwarding said original asynchronous data packet from said local expander to a remote expander over a signal distribution system;

      g)   receiving, at a remote expander, said forwarded original asynchronous data packet;

      h)   delivering said forwarded original asynchronous data packet to at least one
20 peripheral device;

      i)   receiving, at said remote expander, an inbound acknowledgement packet from said peripheral device;

      j)   forwarding said inbound acknowledgement packet from said remote expander to said local expander over said signal distribution system;

25   k)   storing, in a packet buffer at said local expander, said inbound acknowledgement packet;

      l)   receiving, at said local expander, a subsequent notification of asynchronous data from said host controller;

      m)   receiving, at said local expander, a subsequent asynchronous data packet from
30 said host controller; and

            i)   retrieving said stored inbound acknowledgement packet from said packet buffer; and

            ii)   delivering said retrieved inbound acknowledgement packet to said host controller.

35   16. A method as claimed in Claim 15 additionally comprising the following step after step (e) of Claim 15, namely:

      i)   generating an acknowledgement packet at said local expander; and

      ii)   delivering said acknowledgement packet to said host controller.

17. A method as claimed in Claim 15 additionally comprising the following step after step (e) of Claim 15, namely:

    i) Determining whether said local expander already possesses said inbound acknowledgement packet;

5   ii) Generating a negative acknowledgement packet if no such inbound acknowledgement packet is present; and

    iii) Delivering said negative acknowledgement packet to said host controller.

18. A method as claimed in Claim 15 wherein, additionally, a guard time is imposed after a data packet is transmitted from a remote expander to a USB device, which guard time is

10 set to a value that is dependent upon the transfer type of said transmitted data packet, said method comprising:

    a) Receiving, at a remote expander, an outbound data packet,

    b) Determining, at a remote expander, the transfer type of said outbound data packet,

15   c) Forwarding said outbound data packet from said remote expander to a USB device,

    d) Setting the value of a transmission guard timer to a value that is dependent upon said determined transfer type; and

    e) Inhibiting further outbound transmissions until said guard timer has expired.

20 19. A method as claimed in Claim 1 wherein said host controller is a PC, and said peripheral device is a camera, a mouse, a keyboard, a monitor or a speaker or speakers.

20. A method as in claim 1 wherein said extended distance exceeds 5 meters.

21. A method as claimed in Claim 20 wherein said extended distance exceeds 30 meters.

25 22. A method as claimed in Claim 21 wherein said extended distance is equal to or exceeds 100 meters.

23. A method as in claim 1 wherein said signal distribution system utilizes unshielded twisted pair (UTP) wiring.

24. A method as in claim 1 wherein said signal distribution system utilizes fibre optic

30 cabling.

25.   A method as in claim 1 wherein said signal distribution system utilizes wireless transmission.

26.   An apparatus for transmission of a digital signal over an extended distance comprising:

a local expander comprising means for receiving a request for a data signal from a host controller which host controller is connected to said local expander;

means in said local expander for generating an outgoing transmission signal;

means in said local expander for sending said outgoing transmission signal to a remote expander, which ~~signals are~~ *which outgoing transmission signal is* sent over a signal distribution system;

a remote expander comprising means for receiving said outgoing transmission signal;

means in said remote expander for generating a digital signal from said outgoing transmission signal;

means in said remote expander for forwarding said digital signal to at least one peripheral device, which peripheral device is connected to said remote expander;

means in said remote expander for receiving inbound digital signals from ~~said peripheral devices;~~ *said peripheral device.*

means in said remote expander for converting said inbound digital signals to an inbound transmission signal;

means in said remote expander for sending said inbound transmission signal to said local expander, ~~which signals are~~ *which inbound transmission signal is* sent over said signal distribution system;

means in said local expander for receiving said inbound transmission signal;

means in said local expander for generating a digital signal from said inbound transmission; and

means in said remote expander for forwarding said digital signal to said host controller.

27.   An apparatus as claimed in Claim 26 wherein said data signal is a time relevant data signal.

28.   An apparatus as claimed in Claim 27 wherein said time relevant signal is a digital signal which conforms to the USB Specification; and said time relevant signal represent isochronous data.

29.   An apparatus as claimed in Claim 28 wherein said local expander additionally comprises:

means for storing said inbound signal as a stored inbound signal;

means for analysing said digital signal from said host controller to recognize a subsequent request for transmission of said time relevant digital signal; and

means for sending said stored inbound signal to said host controller in response to said subsequent request.

30. An apparatus as claimed in Claim 26 wherein said digital signal is a non time-relevant signal which conforms to the USB Specification; and said non time-relevant signal
5 represents asynchronous data.

31. An apparatus as claimed in Claim 30 for transmission of a digital signal over an extended distance comprising:

a) a local expander comprising means for receiving a request for a non time-relevant data signal from a host controller which host controller is connected to said local
10 expander;

b) means in said local expander for generating an outgoing transmission signal;

c) means in said local expander for sending said outgoing transmission signal to a remote expander, which signals are sent over a signal distribution system; *which outgoing transmission signal is*

d) a remote expander comprising means for receiving said outgoing transmission
15 signal;

e) means in said remote expander for generating a digital signal from said outgoing transmission signal;

f) means in said remote expander for forwarding said digital signal to at least one peripheral device, which peripheral device is connected to said remote expander; *said peripheral*
20 g) means in said remote expander for receiving inbound digital signals from said *device,* peripheral devices;

h) means in said remote expander for converting said inbound digital signals to an inbound transmission signal;

i) means in said remote expander for sending said inbound transmission signal to said local expander, which signals are sent over said signal distribution system; *which inbound transmission signal is*
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j) means in said local expander for receiving said inbound transmission signal;

k) means in said local expander for generating a digital signal from said inbound transmission; and

l) means in said remote expander for forwarding said digital signal to said host
30 controller.

32. An apparatus as claimed in Claim 31 wherein said local expander additionally comprises:

a) means for storing said inbound signal as a stored inbound signal;

b) means for analysing said digital signal from said host controller to recognize a
35 subsequent request for transmission of said non time-relevant digital signal; and

c) means for sending said stored inbound signal to said host controller in response to said subsequent request.

33. An apparatus as claimed in Claim 26 wherein said extended distance exceeds 5 meters.

5   34. An apparatus as claimed in Claim 26 wherein said extended distance exceeds 30 meters.

35. An apparatus as claimed in Claim 26 wherein said extended distance is equal to or exceeds 100 meters.

36. An apparatus as claimed in Claim 26 wherein said signal distribution system
10   utilizes unshielded twisted pair (UTP) wiring.

37. An apparatus as claimed in Claim 26 wherein said signal distribution system utilizes fibre optic cabling.

38. An apparatus as claimed in Claim 26 wherein said signal distribution system utilizes wireless transmission.

15   39. An apparatus as claimed in Claim 26 wherein said host controller is a PC, and said peripheral devices is a camera, a mouse, a keyboard, a monitor or a speaker or speakers.